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A SUSTAINABLE E-WASTE MANAGEMENT MODEL FOR EMERGING ECONOMIES AND DEVELOPING COUNTRIES

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ABSTRACT

This empirical study aims to develop an efficient e-waste management model for emerging economies and developing countries. To propose the same, first, the critical factors for sustainable e-waste management have been identified from both suppliers and consumers, with a combination of judgement and convenient sampling. The model has been proposed through qualitative analysis taking into account the strengths, weaknesses, opportunities, and threats of the informal scenario of e-waste handling, that is predominant in these nations. The research indicates the economic, social, and environmental benefits of the model, and, thus, offers valuable academic insights necessary to understand the e-waste solutions in the background of developing countries like Bangladesh. It can also assist the public and private organizations to realize the critical factors and their roles required to create a sustainable e-waste management framework.

Keywords: e-waste, EOL electronics, sustainability, people, environment, informal sectors, Bangladesh

Paper Type: Research Paper

1. INTRODUCTION

The volume of electronic waste or e-waste is increasing at 3 to 5 percent per year, approximately 3 times faster than other individual waste streams in the solid waste sector (Schwarzer et al., 2005). Around 20–50 million tons of e-waste is generated globally in a year (Dat et al., 2012). Proper disposition and recycling of e-waste has become a major concern for governments and organizations across the globe in recent years.

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When developed countries incorporate 'closed-loop' economies and extended producer responsibility, many developing nations, on the contrary, lack the necessary infrastructure, along with the financial and institutional resources for sustainable e-waste management (Schluep et al., 2013). Although proper handling of e-waste in less-developed countries has received significant academic attention, the existing studies mostly investigate the health, socio-economic, and environmental issues (for example, Frazzoli et al., 2010; Herat, 2008; Li, Duan, & Shi, 2011; Li et al., 2011; Muenhor et al., 2010; Xing et al., 2009, etc.), and discuss solutions from a policy implications perspective (Ansari et al., 2010; Garlapati, 2016; Herat & Pariatamby, 2012, etc.). Considering the gap in research scope, the objective of this empirical study is to design a sustainable e-waste management model for emerging economies and developing countries, with special focus on Bangladesh, a developing nation; in South Asia.

Today Bangladesh is a common destinations for e-waste along with India, Sri Lanka, Pakistan, Malaysia, Vietnam, Nigeria, etc. (Herat & Pariatamby, 2012). Besides, the quantity of a couple of most common consumer electronic products, namely television and cell phone, gives an approximate idea about the enormous e-waste generated in the country. The number of active cell phone subscribers is 154.179 million in August, 2018 (BTRC, 2018). Next, 18.68 million household hare access to television, which is 58.91 percent of the total house-have holds (BBS, 2017).

Driven by the fast urbanization, improvement in income per capita, and an increasing interest is consumer electronics items (Chowdhury et al., 2014; Balabanič, Rupnik, & Klemenčič, 2011), the volume of e-waste is growing every year. The economy does not have the data on actual volume of e-waste and lacks a take back or collection system. Although the government has launched 3R strategy, it is focused more on solid waste management (Chowdhury et al., 2014; Yousuf & Reza, 2013), whereas the Electrical and Electronic Waste (Management and Handling) Rules, 2011, are yet to be enacted in a full-fledged manner. Furthermore, as the economic features and social structure in developing countries, specifically in Asia and Africa, are different from that of the developed world, both technologies to adapt and infrastructure to develop must conform to the local conditions (Herat & Pariatamby, 2012).

In this backdrop, the study aims to propose a model, that integrates economic, social and environmental benefits, for sustainable e-waste management in emerging economies and developing countries. In doing so the research offers valuable academic insights necessary to understand the suitable e-waste solutions in these nations; especially, with a model that integrates the strengths, weaknesses, opportunities, and threats of the informal e-waste scenario, predominant in these nations.

It can also assist the public and private organizations to understand the critical factors and their roles required to create a sustainable e-waste management framework. The rest of the paper is organized as follows. Section two and three discusses the existing literate and research methodology, respectively. Section four presents the discussion of the study along with findings and analyses.

Then, section five summarizes the academic and managerial implications. Lastly, section six concludes the study with the limitations and directions for future research.

2. LITERATURE REVIEW

E-waste refers to End-of-Life (EOL) electronic and electrical products, televisions, monitors, computers, printers, chips, motherboards, audio and stereo equipment, telephones, cell phones, wireless devices, video cameras, fax machines, photocopy machines, etc., which include most small and large appliances used by modern households and organizations (Garlapati, 2016; Herat & Pariatamby, 2012). E-waste contains a broad variety of toxic substances, such as heavy metals and persistent organic pollutants (Frazzoli et al., 2010), and, so, is considered as hazardous waste under the Basel Convention. Some of these substances have been phased out by law, but are present in older equipment; while some are still used in manufacturing, for instance, mercury is used in many latest electronic devices (Schluep et al., 2013). Therefore, e-waste management is concerned with handling the EOL electronic and electrical appliances in order to minimize the volume of e-waste, provide occupational safety to the workers, and utilize cost-efficient, socially-responsible, and eco-friendly techniques (Garlapati, 2016; Schluep et al., 2013; Yousuf & Reza, 2013).

The existing literature on e-waste can be divided into two major streams. The first category of research investigates the socio-economic problems and environmental threats from e-waste (e.g., Herat, 2008; Li et al., 2011; Li, Duan, & Shi, 2011; Frazzoli et al., 2010; Muenhor et al., 2010; Tue et al., 2010; Wang et al., 2009; Wu et al., 2009, etc.).

The second category specifies the challenges for e-waste management and proposes solutions mostly from a policy implications perspective (e.g., Garlapati, 2016; Schluep et al., 2013; Herat & Pariatamby, 2012; Khan et al., 2014, etc.). When e-waste is improperly managed, which is prevalent in developing countries and countries in transition, human health and the eco-system are at severe risks (Schluep et al., 2013). In addition to causing the direct and local exposure (Ma et al., 2008), e-waste influences the environment-to-food chains contamination and, thus, affects the general population and their future generations (Frazzoli et al., 2010).

Figure 1 shows how the lethal materials from e-waste spread by deposition to ground, irrigation, uptake by aquatic organisms, etc. and affect humans through inhalation, contact with soil and dust, and oral intake of contaminated food and drinking water, etc.

The health consequences are illnesses related to thyroid, reproduction, lungs, cell functioning, and so on (Balabanič, Rupnik, & Klemenčič, 2011; Garlapati, 2016; Tue et al., 2010; Wang et al., 2009; Wu et al., 2009; Xing et al., 2009). The risks are more critical for emerging economies and developing countries, since the informal sectors are involved in e-waste recovery and recycle chain, and use crude and perilous techniques, particularly for disposition and recycling (Garlapati, 2016; Herat & Pariatamby, 2012; Schluep et al., 2013; Yousuf & Reza, 2013).

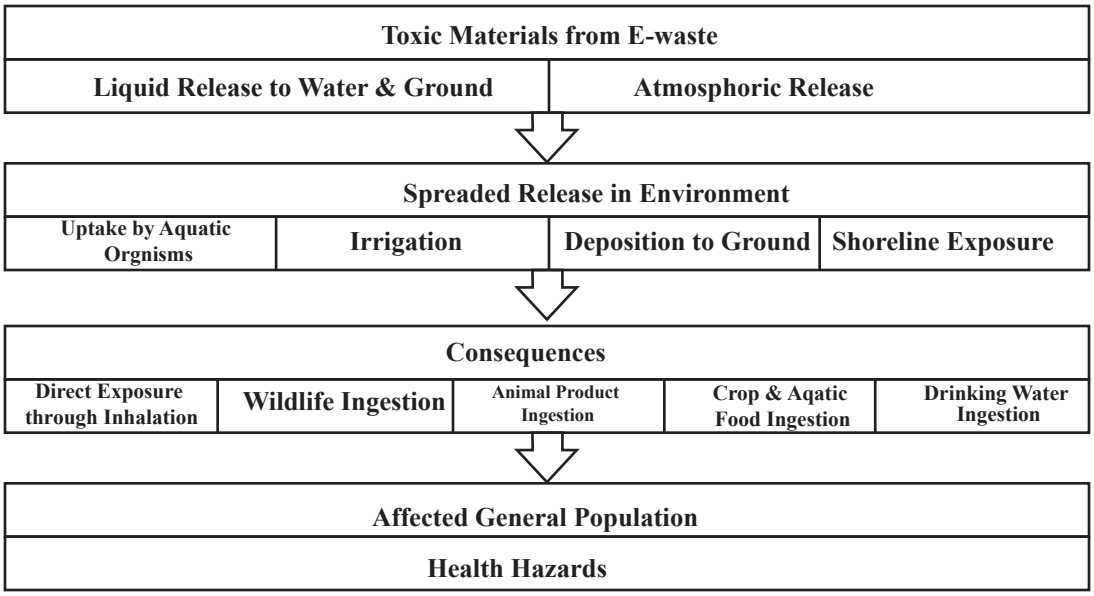

Figure 1: Dangerous Impacts of E-waste Source: Frazzoli et al., 2010

While there are significant differences between the informal and formal scenarios of e-waste recycling, each has its strengths, weaknesses, opportunities and threats (as shown in Table 1). So, the best solution for these nations can only be derived by combining strengths and opportunities of both systems, for instance, high collection efficiency of the informal scenario with state-of-the-art processing facilities of a formal system. Recently, an alternative business model has been implemented in Bangalore, India, by transferring informal wet chemical processes to advanced recycling technologies, and targeted to combine 'the best of both worlds' (Wang et al., 2012).

Through financial incentives and training to the informal sectors for collection and recovery, together with a formal intermediary for buying and selling activities, the model proves that 'the efficient and sustainable recovery of secondary resources from e-waste is a market opportunity for developing countries' (Schluep et al., 2013). Moreover, environmentally sound and socially responsible e-waste management requires the establishment of collection centers, transportation, treatment, storage, recovery and disposal, at national and/or regional levels (Garlapati, 2016).

Scholars have also identified that, there are both challenges and opportunities for developing economies in e-waste management (e.g. Garlapati, 2016; Herat & Pariatamby, 2012; Lepawsky & Billah, 2011; Schluep et al., 2013, Wang et al., 2012). The major challenges for the policy-makers in these countries are, arranging funds and investment to develop formal recycling infrastructure, informing public agencies, organizations, and common people about the hazardous nature of e-waste, creating proper infrastructure for collection/take-back and recycling, and developing rules and regulations to deal with the issue (Osibanjo & Nnorom, 2007).

They also need to achieve efficiencies in the informal sectors, by realizing the environmental and social aspects of these sectors (Wang et al., 2012).

Table 1: SWOT Analysis of E-waste Recycling Chain in Formal vs. Informal Scenarios

	Formal scenario	Informal scenario
Strengths	Access to state-of-the-art end-processing facilities with high metal recovery efficiency	High collection efficiency; efficient deep manual dismantling and sorting; and low labor costs give advantage to manual techniques over mechanical technologies in the pre-processing steps
Weaknesses	Low efficiency in collection; often low efficiency in (mechanized) pre-processing steps	Medium efficiency in dismantling and sorting; low efficiency in end-processing steps coupled with adverse impacts on humans and the environment
Opportunities	Improvement of collection efficiency; technology improvement in pre-processing steps	Improvement of efficiency in the pre-processing steps through skills development for dismantling and sorting; implementation of alternative business models; providing an interface between informal and formal sector
Threats	'Informal' activities in the collection systems	Bad business practice (bribery, 'cherry picking' of valuables only, illegal dumping of non-valuables, etc.); lack of government support (no acceptance of informal sector, administrative hurdles for receiving export licenses, etc.)

Source: Schluep et al., 2013

In addition, there are research based on the e-waste scenario in Bangladesh (Ansari et al., 2010; Shumon, Arif-Uz-Zaman, & Rahman, 2011; Lepawsky & Billah, 2011; Sultana, Shirin, & Zahan, 2018). Nevertheless, most of these studies take a policy implications perspective. They also concur in findings that, while economic value addition and social benefits from current e-waste chain are significant, its harmful effects on people and environment are largely neglected. Although the rubbish electronics recovery and recycling chain is a significant source of metals, plastic, and glass for domestic production, and the informal sectors are estimated to employ 200,000 people directly in Bangladesh, the risks of poor working condition, workers' health, and environmental damage cannot be neglected (Lepawsky & Billah, 2011). Most of the e-waste in the country is dumped in open landfills and water bodies (Herat & Pariatamby 2012). Only 15 percent of the total waste (mostly inorganic) generated in Dhaka, the capital of Bangladesh, are estimated to be recycled (Ahmed, 2011).

3. RESEARCH METHODOLOGY

The research is based on primary data collected from surveys and interviews. The primary data has been comprehended with secondary data collected from webpages and statistical records. The broad research question has three parts: what factors are critical for creating a sustainable e-waste management framework, what is an appropriate e-waste model for developing countries and emerging economies, and what benefits these nations can acquire from the proposed model?

3.1 Study Design

Qualitative methodology is the broadest sense to research that produces descriptive data with the aim to develop concepts, insights and understanding, instead of analyzing data to assess pre-conceived model, hypothesis or theory (Taylor, Bogdan, & DeVault, 2015). Considering the empirical nature of the study, the authors incorporated a flexible research question and qualitative approach. Furthermore, descriptive research is more suitable for the study, because it intends to develop an e-waste management model for developing economies, an area relatively under-researched, whereas the data collection methods include various fact-finding methods like surveys (Kothari, 2007).

3.2 Selection of Samples and Critical Factors

The research focuses on consumers electronics (mainly TVs and cell phones) and includes two important entities from the consumer electronics industry of Bangladesh, namely the large organizations, first, the suppliers, the sellers of own brands and distributors/dealers of international brandsi, and, secondly, the consumers. The geographic scope of the study was Dhaka, where the most e-waste is generated, and which is the center of present rubbish electronics chain. For the organization survey,

150 experienced employees from 7 leading organizations in the Bangladeshi consumer electronics industry were selected through personal contacts to ensure participants were both accessible and cooperative (Bell & Bryman, 2007), and to enable frank and open discussions (Anisul Huq, Stevenson, & Zorzini, 2014). Another set of 150 employees from 65 firms, related to electrical and electronics industry, was selected in the same manner to check whether any biasness exits in the suppliers' perspective. The survey was followed by phone interviews with 25 experienced key people engaged in major supply chain activities in the selected organizations.

For the consumer survey, 250 educated, financially-solvent, and knowledgeable urban consumers from separate households were selected through personal contacts to ensure the respondents are able to evaluate the critical factors according to their importance. So, the samples were selected through a combination of judgement and convenient sampling. From literature review, the critical factors for e-waste management were selected, while a few have been identified later as primary data collection continued.

3.3 Primary Data Collection

Primary data was collected between March and August, 2017. The surveys were administered by phone and email with semi-structured questionnaires. The phone interviews were conducted with a checklist. The organizations survey aimed at identifying the significant factors from the suppliers' point of view. The factors were categorized into positive, which will serve as opportunities for sustainable e-waste management, and negative, which are likely to serve as threats. The second survey focused on evaluating similar factors from the consumers' point of view. However, to keep the survey convenient for the respondents, a smaller list of factors, irrespective of their nature, was used. Interviews were conducted at the end of data collection to fine-tune the survey findings.

Table 2: Critical Factors for E-waste Management, from Consumer Perspective

Factors	Mean
A mandatory take-back/collection system (Garlapati, 2016)	4.168
Convenient collection locations (Identified from primary data)	4.116
Government initiatives to create a legal framework (Osibanjo & Nnorom, 2007)	4.105
Proper EOL strategies from the manufacturers (Sultana, Shirin, & Zahan, 2018)	4.021
Role of formal and informal institutes to create awareness (Garlapati, 2016)	4.042
Improve efficiency of current e-waste handling chain (Herat & Pariatamby, 2012)	3.984

Source: Study Result; Consumer Survey

3.4 Data Analysis Methods

The respondents were asked to rate each factor in a Likert Scale, which ranged from 5 to 1 (5=Strongly Agree; 4=Agree; 3=Not Sure; 2=Disagree, and 1=Strongly Disagree). The summary of collected data has been presented with simple quantitative technique like the numerical mean. The proposed model has been developed through profound qualitative analysis.

4. DISCUSSION

The first sub-section identifies the critical factors for sustainable e-waste management and the second proposes an appropriate e-waste model for emerging economies and developing countries. Finally, the discussion ends with the importance of government participation, as well as the economic, social and environmental benefits of the model.

4.1 Findings from Surveys and Interviews

Majority of the respondents (72 percent out of 500) agreed that, they know about the negative impacts of e-waste, but are unaware of the sustainable solutions. The consumers have identified the significant factors for implementing proper e-waste management are: developing a mandatory take-back/collection system, specifically, creating convenient collection locations for consumers, government initiatives to create a legal framework, proper EOL strategies from the manufactures, which require suppliers' participation, the role of formal and informal institutes in creating consumer awareness, and improvement of existing informal e-waste recovery and recycling chain to increase efficiency (as shown in Table 2).

In addition, the suppliers selected the significant negative factors as, inadequate legal framework to ensure proper e-waste management, lack of e-waste data and statistics, little awareness about dangerous impacts e-waste among public agencies, organizations, and common people, absence of EOL strategies from the global manufacturers, insufficient resources, specifically financial, technical, and human, to implement a sustainable e-waste framework, and lack of infrastructure for collection/take back and recycling. On the other hand, the factors identified as opportunities are, predicted profitability of organizations involved in sustainable e-waste management, formal pressure for compliance with rules on regulations on environment, as well as workers' health and safety, growing consumer interest for 'green' products and technology, the possibility of transferring skills and resources from the informal sectors into a formal e-waste system, and growing informal pressure to design strategies for corporate social responsibility (as shown in Table 3).

From the surveys, a few issues had been identified for detailed discussion in the interviews. First, currently there are no EOL policies for Bangladesh from the global manufactures. If the manufacturers design EOL guidelines for the country, the possibility of non-compliance by the local suppliers without a proper monitoring system exit. Therefore, the suppliers insisted more on a legal framework and formal monitoring system to ensure all the market players are similarly involved in the e-waste management framework. Then, the distributors/dealers lack adequate financial and human resources to participate in e-waste management. If any organization collaborates with the manufacturers to implement EOL strategy, its costs and product prices may rise. They are concerned that, their profitability might decrease because of the price sensitivity of Bangladeshi consumers, and fierce rivalry among competitors, who have not adopted such a strategy. Again, it implies the necessity of equal participation by all suppliers.

Table 3: Critical Factors for E-waste Management, from Supplier Perspective

Factors as Threats	Mean
Inadequate rules and regulations (Herat & Pariatamby, 2012; Osibanjo & Nnorom, 2007)	**4.320**
Lack of e-waste data and statistics (Herat & Pariatamby, 2012; Lepawsky & Billah, 2011)	**4.256**
Little awareness about the negative impacts (Osibanjo & Nnorom, 2007; Sultana, Shirin, & Zahan, 2018)	**4.240**
Lack of EOL strategies from the manufacturers (Sultana, Shirin, & Zahan, 2018)	**4.176**
Shortage of skilled workers, technology, and financial resources (Garlapati, 2016; Herat & Pariatamby, 2012; Schluep et al. 2013; Sultana, Shirin, & Zahan, 2018)	**3.928**
Inadequate infrastructure for collection/take back and recycling (Garlapati, 2016; Osibanjo & Nnorom, 2007)	**3.888**
Factors as Threats	**Mean**
Predicted higher profitability of organizations (Lepawsky & Billah, 2011; Schluep et al. 2013)	**4.488**
Formal pressure for compliance with regulations (Identified from primary data)	**4.464**
Growing consumer interest for green products and technology (Khan et al., 2014)	**4.368**
Transfer of the existing skills and resources to a formal system (Schluep et al. 2013)	**4.224**
Informal pressure for corporate social responsibility (Identified from primary data)	**4.221**

Source: Study Result; Organization Survey

More importantly, instead of transferring a successful model from technologically-advanced and financially-solvent countries, a different model is necessary for developing countries like Bangladesh, taking into account its labor-intensiveness and informal sectors in e-waste handling. The experts also suggested that, consumer awareness is very important for any sustainability planning because both the manufacturers and suppliers will emphasize more on 'green' products and technology, when there is significant demand for such products in the market.

4.2 The Sustainable E-waste Management Model

The proposed e-waste model consists of six major steps, collection of EOL electronics; transportation of collected items to centralized locations; processing and disposal of e-waste; recycling of useable materials; export of recycled materials and using the same for domestic manufacturing; and sales of electrical and electronic appliances to close the loop. Developed based on the general e-waste framework in developed nations, the model includes necessary changes for developing countries and emerging economies (as shown in Figure 2).

Collection Centers for EOL Electronics: The collection points of EOL electronics should be at convenient locations to reduce the consumer difficulty related to transport costs and hassles. Therefore, creating collection centers in the education institutes and work places is a feasible solution. The collection centers will store, keep regular record of the incoming materials (quantity and weight), and, then, transfer the records to the government. The efforts of the centers can be rewarded with non-monetary incentives, such as study materials to the education institutes and office supplies to the organizations, for free and at reduced prices.

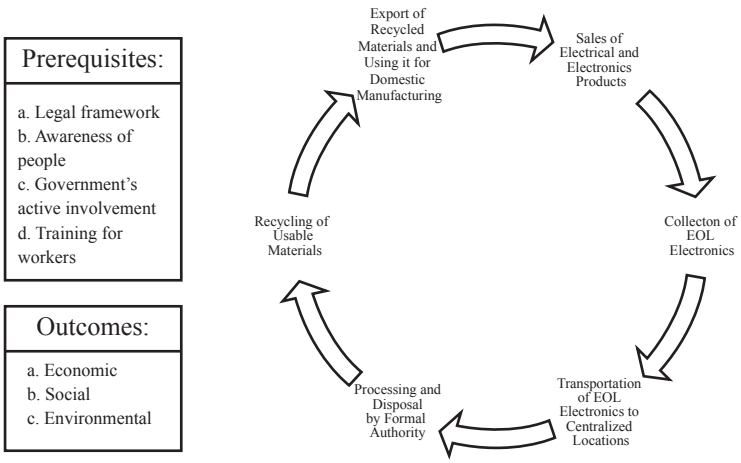

Figure 2: The Sustainable E-waste Management Model for Emerging Economies

Transport Facilities to and from Centralized Locations: A selected network for transporters will be assigned for carrying EOL electronics to a centralized location and from the location to disposal facilities. A specific network is necessary to exercise strict monitoring so the collected items are not sold illegally during transport.
Processing EOL Electronics by a Public Private Partnership (PPP): A PPP is vital between the public agencies and domestic/foreign organizations to perform the processing and disposal functions. Furthermore, the government needs to create a central database for e-waste by recording imported quantity of electronic products, surveying e-waste inventory among the households and businesses, and combining records from the collection centers.

To ensure a uniform performance of the overall e-waste chain, centralized locations will be established in each significant area, especially at the metropolitan cities. These locations must be chosen carefully so that transport from and to becomes cost-effective and fast. The PPP can employ the skilled workers from the informal rubbish electronics industry. However, training and development of workers is essential, so the existing workers are able to meet their new job requirements, and additional workers are created to meet the industry growth.

The workers will inspect and sort the incoming items for further processing:
a) The defective electronic devices will be repaired and sold as refurbished products;
b) The non-repairable devices will be dismantled to separate usable components and parts;
c) The usable component-parts will be used for remanufacturing;
d) The usable materials will be separated for recycling; and
e) The unusable items will be disposed in a safer manner by the same PPP organization, or a different institute monitored by the PPP.

Recycling Industry for Usable Materials: The materials suitable for recycling will be transferred to recycling plants by the same transport network or transport provided by the recycling organizations. New firms, both local and foreign, may enter into the industry to invest in advanced recycling. The role of the government is indirect but important to promote the infant recycling industry. Besides, expertise and skills from existing facilities, for example, recycling of industrial batteries in Bangladesh, can be utilized for gradually moving onto state-of-the-art recycling technology.

4.3 The Necessity for Government Participation

The pre-requisites of the model are, training to workers involved in the entire e-waste chain, secondly, creating awareness about e-waste management with sustainability among general population, and finally developing a legal framework to prevent illegal import and handling of e-waste. The important role of the government for these activities has been supported by previous studies (Garlapati, 2016; Herat & Pariatamby, 2012; Schluep et al., 2013; Yousuf & Reza, 2013). In addition, the current study proposes that, the government of emerging and developing economies should directly participate in the e-waste management framework.

The active intervention of the government is necessary, especially, at the initial period of sustainable e-waste management to cover all geographic areas, acquire adequate funds, and improve the efficiency of the model. Besides, it will be difficult to have access to e-waste inventory of households and organizations and to cover all the geographic areas for collecting EOL electronics with private initiatives only. After the industry flourishes, some or all of the activities may be transferred to the private sectors, whereas a monitoring body of experts should check the performance of the overall e-waste system and recommend improvement strategies. Last of all, the government has the authority to negotiate with the global manufacturers of consumer electronics, so the latter design EOL strategies to confront the e-waste challenges in the destination markets created by their brands. It may need to form alliances with the neighbor nations, so multiple countries are able to take advantage from common e-waste facilities.

4.4 Sustainability Features of the Proposed Model

First, the model offers financial revenue to the related organizations with higher recovery rate (Schluep et al., 2013) in the backdrop of opportunities for domestic production and export. The earnings are expected to exceed the implementation costs, when the profit margin from dismantling and resale of a typical CRT monitor in Dhaka, Bangladesh is as high as 230 percent (Lepawsky & Billah 2011). Besides, the recycled materials and refurbished electronic products will reduce demand for imports (Herat & Pariatamby, 2012). Secondly, the model suggests social benefits by transferring human resource from the informal e-waste chain into the formal system, so severe job cuts, deteriorated living standard, and consequent social unrest can be circumvented. It will create new jobs and improve existing jobs with safe working condition and, thus, minimizes the negative impacts on workers and population nearby e-waste sites. Regarding environmental benefits, the model targets to collect most EOL electronics, lower residuals after reuse or recycling, and dispose residuals with safer methods, and, so, reduces the negative effects of e-waste on general population and the eco-system.

5. ACADEMIC AND MANAGERIAL IMPLICATIONS

Considering developing countries are expected to produce twice the e-waste generated by developed economies in next five years (Garlapati, 2016), and the recovery and recycling of EOL electronics would become too complex to handle with informal scenarios (Schluep et al., 2013), emerging economies and developing countries must transfer their resources, skills, and infrastructure from informal e-waste handling to formal e-waste management in a sustainable manner in days ahead. The proposed model aims to assist the sustainable e-waste management framework, and, thus, offers valuable academic insights to understand the suitable e-waste solutions in these nations. Secondly, the study will be useful to the public agencies and private organizations in order to realize the critical factors and their roles required for the sustainable e-waste model. With the economic, social, and environmental benefits of the model specified, the study provides motivation to managers for its successful implementation. Last of all, the research also confirms the necessity of e-waste management at national and/or regional level with active government intervention, which can aid the policy makers to develop effective long-term strategies on sustainability.

6. CONCLUSION AND DIRECTIONS FOR FUTURE RESEARCH

The study aims to design an efficient solution for sustainable e-waste management in emerging economies and developing countries, considering the increasing necessity of proper e-waste handing in these nations, and the necessity of a different model that conforms with the local conditions different from developed economies. Besides, the existing literature has not proposed any model or specific framework for sustainable e-waste management in developing countries like Bangladesh. Despite its limitations of qualitative research, the current study has identified the critical factors for e-waste management framework and proposed a model for implementing the same in these nations. Although the scope of the research is Bangladesh, its analysis and recommendations will be useful to similar economies, though a little change might be necessary for local differences in other nations. Moreover, the study has emphasized the economic, social, and environmental outcomes of the model and outlined the theoretical and practical implications of the research. Future scholars could incorporate more consumer electronics items to generalize the findings and consider multiple developing countries to investigate e-waste solutions with a cross-cultural perspective.

ENDNOTES:

(i) The total volume of manufacturing (15 percent) and assembly (25 percent) is much lower compared to finished-product imports (60 percent) (Sultana, Shirin, & Zahan, 2018).

(ii) Since the response from the second set of organizations was similar, it has been inferred that the suppliers' viewpoint is valid and reliable.

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